

2016

## Dosing Accuracy When Administering Oral Medications

Chelsea Hughes  
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# DOSING ACCURACY WHEN ADMINISTERING ORAL MEDICATIONS

by

CHELSEA HUGHES

A thesis submitted in partial fulfillment of the requirements  
for the Honors in the Major Program in Nursing  
in the College of Nursing  
and in The Burnett Honors College  
at the University of Central Florida  
Orlando, Florida

Spring Term 2016

Thesis Chair: Dr. Kelly Allred

## **ABSTRACT**

Inaccurate dosing of children's liquid medication is a major problem that causes adverse effects for children every year. In order to prevent these errors, education for at risk parents is essential. A survey and observational study was done in order to identify parents/caregivers who make dosing errors when measuring out liquid medication for their children. A total of 25 parents/caregivers with children admitted to Arnold Palmer Hospital were included in this study. Study participants completed a survey that included demographic data as well as parenting experience. The parents were directly observed measuring a dose of corn syrup using Children's liquid Tylenol<sup>®</sup> dosing instructions. The research participants were offered a variety of common measuring devices and they chose the one they most often used at home. Data indicated a high incidence of dosing errors made by a variety of participants. Of the 25 research participants, 13 (52%) made an error greater than 20% when measuring out the dose based on the provided instructions and their child's weight. This data suggests nurses need to include dosing education for all parents at discharge. This study has shown that many parents are at risk for making errors when measuring medication. Effective discharge education on the importance of measuring medication accurately can prevent these errors and the adverse effects they cause.

## **DEDICATION**

For my hard-working father, thank you for motivating me to never give up and believing in me no matter what. I wouldn't be here without you. For my loving mother, thank you for supporting me through all of my dreams and for loving me unconditionally.

## **ACKNOWLEDGMENTS**

There have been many people that have made this thesis possible. First, I want to thank Dr. Kelly Allred, my wonderful thesis chair. Thank you for supporting me and never giving up on me or this study. I cannot put into words my gratitude towards you for all you have done for me throughout this exciting journey. I would not have been able to do this without your guidance and support. Thank you to my committee members, Dr. Leslee Damato-Kubiet and Dr. Maria Cannarozzi. I appreciate you believing in me to complete this study from the very beginning. Also, Dr. Harriet Miller, you guided me through this new adventure and never let me give up. Thank you for your knowledge and perseverance during this process. Thank you all for motivating me to make this thesis the best it could be through your continuous support.

## TABLE OF CONTENTS

ABSTRACT.....	ii
CHAPTER ONE: INTRODUCTION.....	1
Measuring Device Used.....	1
Inconsistent Instructions.....	2
Individual Factors.....	2
Research Problem.....	3
CHAPTER TWO: METHODS.....	5
Survey and Observational Measurement.....	5
Design.....	5
Human Subjects.....	5
Sample.....	6
Setting.....	6
Procedures.....	6
CHAPTER THREE: RESULTS.....	8
Demographic Data.....	8
Quantitative Data.....	8
CHAPTER FOUR: DISCUSSION.....	10
Limitations.....	12
Recommendations for Nursing Practice.....	13
Recommendations for Nursing Education.....	13
Recommendations for Future Research.....	14
APPENDIX A: SURVEY.....	16
APPENDIX B: CHILDREN’S TYLENOL® DOSING INSTRUCTIONS.....	19
APPENDIX C: LETTER OF SUPPORT FROM OPERATIONS MANAGER.....	21
APPENDIX D: RESULTS.....	23
APPENDIX E: UNIVERSITY OF CENTRAL FLORIDA IRB APPROVAL.....	26
REFERENCES.....	29

## **CHAPTER ONE: INTRODUCTION**

More than 70,000 children visit an Emergency Department each year due to medication overdose (Schillie, Shehab, Thomas, & Budnitz, 2009). Children's medications come in many forms, such as capsules, pills, and liquid. While liquid medication is often easier for children to swallow, there is a high potential for error when dosing. There are many factors that can influence these errors and may include the measurement device used, inconsistent dosing instructions, and individual factors of the parent. With such a large number of errors happening each year, it is important to determine and eliminate these factors in order to lower the number of medication errors made by parents each year.

### **Measuring Device Used**

The measuring device used by parents to dose liquid medication is a major variable that can cause errors. There are many measuring devices often used to measure liquid medication, such as medication cups, droppers, household spoons, and droppers. All of these devices are used with varying levels of accuracy. A study done by Yin et al. (2010) aimed to identify which measuring devices yielded the most and least errors. They defined an error as greater than 20% of the intended dose. Each of the 302 parent research participants were asked to measure 5 mL of medication using a dosing cup with printed calibration markings, a dosing cup with etched calibration markings, a dropper, an oral syringe, a dosing spoon, and an oral syringe with a bottle adapter. The researchers found that 9% of parents made an error greater than 20% with an oral syringe while 14% of parents made an error using a dosing spoon. They also found that 69.5% of parents made an error greater than 20% when dosing with a dosing cup with printed

calibration markings. Of the errors made with dosing cups, over 99% of them were overdosed (Yin et al, 2010).

### **Inconsistent Instructions**

The American Academy of Pediatrics (2015) has recommended to the Food and Drug Administration that all labels on liquid medications be listed in metric units only, such as milliliters. They also urge physicians and pharmacists to write prescriptions using only metric units. Regardless of this recommendation, dosing instructions listed on over-the-counter (OTC) and prescription medications are inconsistent. In another study conducted by Yin et al. (2014), medication labels were compared to written prescriptions for 287 parents with children seen in two different pediatric emergency departments in public hospitals. The study found that 36.7% of the labels had units of measurement that were inconsistent with the prescription. They also found that parents often did not use the unit of measurement listed on the label or prescription. In fact, 45% of parents did not use milliliters when milliliters was the unit of measurement listed on the prescription. On the other hand, when the measurement was listed in teaspoons, 36.7% did not use a teaspoon (Yin et al, 2014). These inconsistencies can confuse parents and contribute to medication errors.

### **Individual Factors**

Many other factors can contribute to a parent's ability to accurately dose medications. For one, first language can greatly influence a parent's understanding of the prescribed medication. For Spanish speaking parents, there is an additional obstacle to overcome when receiving a prescription for their child. If the prescription directions are received in English and

the provider only explains the prescription in English, Spanish speaking parents are at a disadvantage. Another factor that could potentially contribute to errors is parenting experience. A parent with their first child might not have as much experience with dosing medications as a parent with their fourth child. Other factors such as parent age and education level might also contribute to likelihood of making a medication error.

According to the Joint Commission (2008), children are more vulnerable than adults to medication errors. For example, because of their rapid growth and wide range of size, children's medication often needs to be dosed based on weight. This often requires the need for more decimal points and fractional dosing. It is extremely important for parents to accurately dose medications for their children, but there are many factors that can cause errors during this process. It is important these factors are addressed before the errors happen in order to prevent harm to children. Part of a nurse's role and responsibility is to complete patient education while discharging patients from the hospital. Therefore, it is important that nurses be aware of these factors in order to promptly address and overcome these barriers through parent education. All of these factors need to be identified in order for nurses to be able to better prepare parents for medication administration to their children.

### **Research Problem**

Measuring liquid medications for children requires knowledge and accuracy. There are many factors that can affect a parent's ability to accurately dose medications for their children. In a study done by Mehmood et al., (2014), 530 parents participated in a study measuring liquid medication using a variety of different sizes of household spoons. A total of 69.1% of parents measured an inaccurate dose when asked to measure 1 teaspoon of liquid medication. Despite

research on this topic, errors are still occurring. Recent research done at Nationwide Children's Hospital found that every year between 2002 and 2012, 63,000 children under six years of age experienced medication errors outside of the hospital (Spiller, 2014). Many studies have been done to analyze specific factors such as measuring device used or health literacy of the parents, but there is limited research that analyzes multiple factors. These factors need to be identified in order for nurses to address these issues.

Overdosing and under-dosing acetaminophen can lead to adverse effects for the child. While under-dosing does not provide a risk of adverse reactions to the medication, it can prevent effective management of child's pain/fever. However, an overdose can lead to life threatening side effects. Possible effects of acetaminophen toxicity can include, liver failure, metabolic acidosis, kidney failure, cerebral edema, and even death (McKay, 2011). In a study done by Saccon, Cantoni, Maiandi, and Panzavolta (2015), it was found that of the 47% of children in their study that received an incorrect dose of acetaminophen, none of the children experienced acetaminophen intoxication. However, with overdoses being given consistently, these children were put at risk for chronic intoxication which can lead to chronic, life-threatening liver failure.

## **CHAPTER TWO: METHODS**

### **Survey and Observational Measurement**

The survey used in this research was developed by the Principal and Co- Investigator, strongly based on other surveys investigating similar phenomena. The one page survey included data such as, age gender, and ethnicity of the parent/caregiver filling out the survey. It also included questions about which measuring device the participant uses at home and how often they measure liquid medication for their child. The survey can be found in Appendix A.

For the observational portion of the study, the participants measured out a dose of corn syrup based on their child's weight and age. Corn syrup was used to most imitate the consistency of typical liquid medication, and limit the exposure of research participants and their children to medication while taking part in the research. The participants were given the measuring device they reported using at home. They were also given an empty Children's Tylenol® box with dosing instructions to determine the dose for their child based on weight. These instructions can be found in Appendix B.

### **Design**

The study included an anonymous survey immediately followed by a direct observation of the participants measuring out a dose of liquid medication. The dose measured by the participant was recorded on their survey by the observer in order to keep all of the data together.

### **Human Subjects**

Approval was obtained from the Institutional Review Board (IRB) at the University of Central Florida. No identifiable information was taken during this study. There were no risks to the participants. The signature on the informed consent was waived by the IRB because this

would add identifiable information to an otherwise anonymous study. Participants were aware that participation was voluntary and they would not be contacted after this session was complete.

### **Sample**

A convenience sample was used for this study. Parents on the approved units at Arnold Palmer Hospital that were in their child's room and met the inclusion criteria were asked to participate. The 25 individuals that agreed to participate during the four data collection days were included.

### **Setting**

This research took place at Arnold Palmer Hospital in Orlando, Florida. The Nursing Operations Manager on 2 separate Acute Pediatric units provided consent to use these units for the study. The letter of approval can be found in Appendix C. Parent's completed the research in their child's hospital room.

### **Procedures**

Participants were approached in their child's room at Arnold Palmer Hospital. A brief description of the study and length of participation were explained to the individuals before they were asked if they would like to participate. For those that declined, no further contact was made. For those who agreed, they were given an informed consent document and the study and its purpose were further explained. Participants were encouraged to ask any questions they had prior to starting. Their signature on the informed consent was not obtained as it had been previously determined by the IRB it was not necessary. Once the participant was ready to begin, they were given the survey to fill out. Clarification was provided regarding survey questions when needed.

After completing the survey, participants were provided the measuring device they indicated they used at home when measuring liquid medication for their child. If the device they typically used was not available, they were asked to choose which device they would use of those available. Participants were given the Children's Tylenol<sup>®</sup> box with dosing instructions. After determining the dose for their child, participants measured this dose using corn syrup. No questions regarding measurement were answered during this time. After measurement of the liquid was complete, the observer recorded the actual measurement on the designated line at the bottom of the survey. The data was not analyzed for accuracy at that time, and information about the accuracy was not provided to the participant. This completed their participation and they were not contacted any further.

## **CHAPTER THREE: RESULTS**

### **Demographic Data**

A total of 25 participants were included in this study. All of the participants were in the room with a child admitted to Arnold Palmer Hospital and self-reported that they measure out liquid medication for that child. While seeking out participants at the hospital, 4 people declined participation and 1 person was only Spanish speaking and was unable to participate. Of the 25 participants, 17 were female (68%) and 8 were male (32%). The age range was 25 to 55 years old, with an average age of 39. When asked about their ethnicity, 40% self-reported as Caucasian (n=10), 20% as African American (n=5), and 40% as Hispanic (n=10). English was the primary language of most participants at 72% (n=18), and 28% of the participants reported Spanish was their first language (n=7). A total of 36% of the participants stated their highest degree was a high school diploma (n=9), 4% received a trade school certificate (n=1), 28% held an AA degree (n=7), 24% held a Bachelor's degree (n=6), and 8% held a Master's degree (n=2). The participant's relationship to the child varied with 64% (n=16) being the mother of the child, 28% (n=7) being the father, and 8% (n=2) being the grandparent. Each participant reported the weight of the child currently admitted to the hospital, and the average weight was 45.6 pounds. Of the 25 participants, 20% had only one child (n=5), 52% had 2-3 children (n=13), and 28% had more than 3 children (n=7). Demographic data is summarized in Appendix D, Table 1.

### **Quantitative Data**

How often each participant measured medication for this child varied with 32% stating more than once a day (n=8), 12% stating once a day (n=3), 12% said once a week (n=3), 16% said once a month (n=4), 20% said less than once a month (n=5), and 8% were unsure of how

often they measure medication for their child (n=2). Participants were asked which measuring device they used at home to measure liquid medication for this child and the most popular device was a 2 tablespoon medicine cup (that typically comes with liquid over the counter medication) with 60% of participants reporting they use this device. Although a household spoon was included on the survey, no participant reported using this to measure medication for their child. When given the choice of which device to use to demonstrate measuring a dose of medication for their child, 92% of participants chose a medicine cup (n=23) and 8% used a measuring teaspoon (n=2). After completing the medication measurement, the participants were asked to rate their perception of the importance of measuring medication to relieve a fever accurately as well as the importance of measuring prescription medication accurately. Each question was rated on a scale of 0 to 5, with 0 representing not important and 5 representing very important. Every participant rated both of these questions as very important. Quantitative data is summarized in Appendix D, Table 2.

## CHAPTER FOUR: DISCUSSION

There was a high incidence of errors among the 25 participants with 13 (52%) making an error greater than 20% deviation from the dose indicated by the dosing instructions. Of these errors, 77% (n=10) were overdose errors. This is significant because acetaminophen overdose has a variety of adverse reactions that range from mild to life-threatening, with repeated errors having a great potential to cause harm. These effects can also depend on the amount of overdose given to the child. In this group of participants, the errors ranged from a 2 mL variation to a 19.5 mL variation from the expected dose for their particular child. An error of 19.5 mL, almost two times the expected dose of 10mL, could have significant effects on the child receiving this dose. Although these doses given for a single instance might not cause life threatening effects, giving these inaccurate doses consistently over time can lead to chronic liver failure. Also, although acetaminophen was used for this study, these errors can occur with any other liquid medication for children. Other medications can cause more adverse effects with smaller variations from the required dose. With such a high incidence of overdosing errors, steps need to be taken to educate parents and prevent these errors from occurring. For parents with children admitted to the hospital, the intervention should include dosing education prior to discharge, and potentially a demonstration of understanding is in order. Providing this education will help parents to be able to more accurately measure any liquid medication prescribed for this child, both prescription and over-the-counter medication. This education should include be addressed to all parents. Nurses should be educating parents in the primary care setting as well. This education can be considered preventative action; educate parents before they have to measure a dose of liquid medication for the child and prevent errors from ever occurring.

When asked to report the measuring device used at home, 4 of the 25 participants reported using more than one device. Out of these 4 participants that chose multiple devices, 3 participants chose a measuring cup and a dropper. The 13 participants that made significant errors in dosing reported using a variety of devices at home. Of the 13 participants, 7 reported using a measuring cup, 4 reported using a syringe, 3 reported using a dropper, and 1 reported using a measuring spoon, while none of them reported using a household spoon. This data is similar to the data for the total participants.

When the participants were asked to choose a device to measure out the medication dose, 23 participants (92%) chose to use a measuring cup. The other 2 participants (8%) chose a measuring teaspoon as their device. However, only 15 participants reported using a measuring cup at home when measuring out liquid medication for the child currently admitted to the hospital. Of the 13 participants that made significant errors, 5 of them reported using a different device than a measuring cup at home, but chose the measuring cup during this research. After reviewing the dosing instructions, the participants may have concluded the measuring cup was the best device for the specific dose required. These participants could have chosen this device for the study because they felt this was the device they were expected to use for accuracy. Since 4 of the 5 participants reported using a syringe at home, they may have chosen the measuring cup due to its similarity to a syringe with multiple measurement markings.

This data suggests the errors in dosing are not linked to the measuring device used by the parents. None of the parents reported using a household spoon at home, which is likely the least accurate device to use due to the variability in how much any given household spoon might hold. Research by Falagas, Vouloumanou, Plessa, Peppas, and Rafailidis (2010) confirm there is a

wide variability in the volume typical household teaspoons and tablespoons hold. The two participants that chose the measuring teaspoon to measure the medication had a required dose of 5 mL (or 1 teaspoon) based on the dosing instructions. This device is adequate for this specific dose. The other 23 participants had required doses that were clearly marked on the measuring cup. All of the participants were able to choose a device that gave them the opportunity to accurately measure the medication. The high incidence of errors that occurred shows the error was due to execution, not the choice of the device. Dosing education that includes demonstration and return demonstration can correct and prevent these errors.

### **Limitations**

This study included 25 participants from Arnold Palmer Hospital. Due to time and resource restrictions, this was a convenience sample size. With a larger sample size, it might be possible to determine correlations between characteristics of research subjects to dosing errors made. Using multiple sites and with more time for data collection, a larger, more diverse sample could have been studied.

Corn syrup was used to take the place of liquid Tylenol<sup>®</sup> in order to avoid risk of bringing medication into the child's room during the study. However, the consistency turned out to be a little thicker than typical liquid medication. With a liquid of closer consistency to liquid Tylenol<sup>®</sup>, the measured dose could be more like what participants would measure with the actual medication. Since the liquid was more viscous, it actually might have been easier to measure out the dose they intended to measure.

## **Recommendations for Nursing Practice**

This study provided evidence that there are likely many parents making errors when administering liquid medications to their children at home. While the study did not find specific factors that correlate with errors, it still provided insight into this vital issue. When children are discharged from the hospital, they are often sent home on prescription medications for their illness. Since parents are not measuring the medication for the child while in the hospital, it is important to address dosing and measuring the medication as part of discharge education. Nurses need to be aware of this problem as well as understand the importance in order to adequately address the problem with every parent/caregiver before they leave the hospital.

Education on dosing and measuring liquid medication should be provided during every discharge in order to prevent medication errors, harm to patients, and readmissions to the hospital because of these errors. Education should include verbal instruction, demonstration, and return demonstration. Better preparing parents to measure liquid medication for their child will help to prevent these dosing errors.

If not already in place, medication dosing education should be added to the routine steps of discharge, regardless of medical diagnosis or prescription medications. Making this step routine for every discharge will hopefully remind nurses to include it in their discharge planning and implement the education while completing the discharge with the patient.

## **Recommendations for Nursing Education**

Discharge planning and education is an important nursing responsibility. It takes practice and nursing judgement in order to execute this skill effectively. Students need to be educated on discharge planning, specifically for pediatric patients. When considering pediatric discharge

planning, it requires more critical thinking and holistic treatment because it involves the patient as well as the patient's parents. This skill can be taught in the classroom, but the student would ideally observe this in the clinical setting, and can be practiced and reinforced in a simulation lab.

Nursing students need to understand the proper way to measure out liquid medication. This skill should be mastered by the time they are in a clinical setting and possibly participating in providing education to patients and caregivers. Students also need to be educated on the importance of accurate dosing. If students understand the importance, they will be able to better convey the need to the parents of the pediatric patients and incorporate it into their care and discharge education.

Nursing students need emphasis on providing education, throughout a hospitalization, at discharge from an acute care hospital, and in the primary care setting. Being able to effectively assess the need and provide the education can make a big difference for the pediatric patient. Students can learn from this study that all parents are in need of education on dosing medication prior to discharge. If this expectation is established during their education and training, hopefully the implementation of this practice once they are providing more independent care will be more consistent and effective.

### **Recommendations for Future Research**

Further research into parent dosing accuracy should be done. This study provided a framework for a larger study with similar methods. This study should be duplicated using a larger sample size at multiple locations, if possible. With a larger sample size, it is possible that correlations will be found relating to dosing errors. To make the situation more realistic for the

research participant, the study could be a multi-session study that includes a session of observation at the home of the participant. Allowing the parent to measure the medication in the place they would normally measure could provide more accurate results. Another possibility for improvement would be conducting an international study. Conducting this study in countries that use only the metric system might provide different results and better insight into the cause of high amounts of errors in America since America does not have one set unit of measurement. Finally, in addition to the steps followed in this study, another study with similar methods should be developed involving education. This study could show the effects of teaching parents correct ways to measure doses if they are observed measuring the dose before and after the education. Reassessing after time has passed can help determine retention of education to prevent dosing errors.

Data from this research study shows a high number of errors parent's make while dosing liquid medication for their children. Although this study could not determine a specific factor that contributed to these errors, both demographic factors and factors related to measuring devices or instructions provided should be explored. This is a serious problem that is effecting thousands of children every year. More research is needed to identify the source of the problem and how to solve it.

## **APPENDIX A: SURVEY**

## Survey

**Gender:** Male \_\_\_\_ Female \_\_\_\_

**Ethnicity:** Caucasian \_\_\_\_ African American \_\_\_\_ Hispanic \_\_\_\_  
Asia/Pacific Islander \_\_\_\_ Other (please list) \_\_\_\_\_

**Age in years:** \_\_\_\_\_

**Number of children:** 1 child \_\_\_\_ 2-3 children \_\_\_\_ 4 or more children \_\_\_\_

**Measuring device used when measuring medication at home:**

Measuring cup \_\_\_\_ Household Spoon \_\_\_\_ Dropper \_\_\_\_  
Other (please list) \_\_\_\_\_

**First language:** English \_\_\_\_ Spanish \_\_\_\_ Other (please list) \_\_\_\_\_

**Highest Degree:** High School Diploma \_\_\_\_ Associate Degree \_\_\_\_  
Bachelor Degree \_\_\_\_ Master Degree \_\_\_\_ Other (please list) \_\_\_\_\_

**Child's Weight:** \_\_\_\_\_

**How often do you measure liquid medication for a child:** More than once a day \_\_\_\_ once a day \_\_\_\_  
Once a week \_\_\_\_ Once a month \_\_\_\_ Less than once a month \_\_\_\_ Unsure \_\_\_\_

**Relationship to Child:** Mother \_\_\_\_ Father \_\_\_\_ Other (please list) \_\_\_\_\_

**Do you measure out liquid medication for this this child?** Yes \_\_\_\_ No \_\_\_\_

---

### RESEARCHER USE ONLY

**CW:** \_\_\_\_\_

**MD:** \_\_\_\_\_

**On a scale of 0 to 5 (with 0 being not important and 5 being very important, please rate the following:**

Importance of measuring Tylenol® accurately? \_\_\_\_\_

Importance of measuring prescription medications accurately? \_\_\_\_\_

**APPENDIX B: CHILDREN'S TYLENOL® DOSING INSTRUCTIONS**

## Drug Facts (continued)

### Directions

- this product does not contain directions or complete warnings for adult use.
- do not give more than directed (see overdose warning)
- shake well before using
- mL = milliliter; tsp = teaspoonful
- find right dose on chart below. If possible, use weight to dose; otherwise, use age.
- remove the child protective cap and squeeze your child's dose into the dosing cup
- repeat dose every 4 hours while symptoms last
- do not give more than 5 times in 24 hours

Weight (lb)	Age (yr)	Dose (mL or tsp) *
under 24	under 2 years	ask a doctor
24-35	2-3 years	5 mL (1 tsp)
36-47	4-5 years	7.5 mL (1½ tsp)
48-59	6-8 years	10 mL (2 tsp)
60-71	9-10 years	12.5 mL (2½ tsp)
72-95	11 years	15 mL (3 tsp)

\* or as directed by a doctor

**Attention:** use only enclosed dosing cup specifically designed for use with this product. Do not use any other dosing device.

### Other information

- each 5 mL (1 tsp) contains: sodium 2 mg

**APPENDIX C: LETTER OF SUPPORT FROM OPERATIONS MANAGER**



ARNOLD PALMER HOSPITAL  
For Children

92 West Miller Street • Orlando, Florida 32806 • 407 649-9111

November 5, 2015

To Whom It May Concern:

I am writing this letter of support for UCF nursing student, Chelsea Hughes's research study "Dosing Errors When Administering Oral Medications". I have reviewed the research protocol (including the data collection tool) and informed consent. I support this research being conducted on the Acute Pediatric Unit (Towers 5 and 6) which I manage, at Arnold Palmer Hospital for Children. Chelsea has offered to coordinate with me and my leadership team the days she will be on the units collecting data. I look forward to hearing the results of her study which may help the discharge teaching for our patients that go home on oral liquid medications. I understand she will only have water as a liquid when collecting data and no medication will be in her possession or used in any part of this research.

Sincerely,

*Lori Culbreth MSN/Ed., RN, CPN*

Lori Culbreth MSN/Ed., RN, CPN  
Nursing Operations Manager  
Acute Pediatrics, Pediatric Orthopedics and Neurology and  
Pediatric Neurodiagnostic Department

## **APPENDIX D: RESULTS**

**Table 1**  
**Characteristics of Participants (N=25)**

	N	%
<b>Gender</b>		
Female	17	68
Male	8	32
<b>Relationship to Child</b>		
Mother	16	64
Father	7	28
Grandparent	2	8
<b>Ethnicity</b>		
Caucasian	10	40
African American	5	20
Hispanic	10	40
<b>First Language</b>		
English	18	72
Spanish	7	28
<b>Number of Children</b>		
1 child	5	20
2-3 children	13	52
More than 3 children	7	28
<b>Highest Degree Held</b>		
High school Diploma	9	36
AA Degree	7	28
Bachelor's Degree	6	24
Master's Degree	2	8
Trade School	1	4

**Table 2**  
**DEGREE OF DOSING ERRORS MADE BY PARTICIPANTS**

Measured Dose (mL)	Required dose per dosing instructions (mL)	Difference between measured and required dose (mL)	Percentage of error
3	5	2	-40%
3	5	2	-40%
7.5	10	2.5	-25%
12.5	15	2.5	-17%
17.5	15	2.5	17%
9	7.5	2.5	20%
15	12.5	2.5	20%
12.5	10	2.5	25%
10	7.5	2.5	33%
10	7.5	2.5	33%
10	7.5	2.5	33%
10	7.5	2.5	33%
10	7.5	2.5	33%
10	7.5	2.5	33%
10	5	5	100%
18	7.5	10.5	140%
29.5	10	19.5	195%

**APPENDIX E: UNIVERSITY OF CENTRAL FLORIDA IRB APPROVAL**



University of Central Florida Institutional Review Board  
Office of Research & Commercialization  
12201 Research Parkway, Suite 501  
Orlando, Florida 32826-3246  
Telephone: 407-823-2901 or 407-882-2276  
[www.research.ucf.edu/compliance/irb.html](http://www.research.ucf.edu/compliance/irb.html)

### Approval of Human Research

From: **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To: **Kelly D. Allred and Co-PI: Chelsea Hughes**

Date: **February 15, 2016**

Dear Researcher:

On 02/15/2016 the IRB approved the following human participant research until 02/14/2017 inclusive:

Type of Review: Submission Response for UCF Initial Review Submission Form  
Expedited Review

Project Title: Dosing Accuracy When Administering Oral Medications

Investigator: Kelly D. Allred

IRB Number: SBE-16-12021

Funding Agency:

Grant Title:

Research ID: N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 02/14/2017, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in IRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

All data, including signed consent forms if applicable, must be retained and secured per protocol for a minimum of five years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained and secured per protocol. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

In the conduct of this research, you are responsible to follow the requirements of the [Investigator Manual](#).

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Patria Davis on 02/15/2016 01:47:30 PM EST

IRB Coordinator

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